SOME EFFECTS OF STORAGE ON SEASONED LUMBER

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SOME EFFECTS OF STORAGE ON SEASONED LUMBER

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The fullest efficiency and satisfaction to be derived from the use of wood in any construction are in a large part dependent upon its moisture content at the time of installation. If users are supplied with lumber suitably dried for the job, there is no apparent reason why they should be concerned about its serviceability so far as shrinking and swelling are concerned.

Some mills machine and ship thoroughly seasoned lumber to wholesale and retail yards, only to find that it is stored in piles unprotected from the weather. Such storage largely offsets the benefits of proper seasoning, because the wood may absorb moisture to an undesirable extent before it is used. This moisture regain followed by a moisture loss during fabrication or use may result in warping and end checking. Correct storage practice is necessary for properly kiln-dried lumber, therefore, to maintain the lumber at the desired moisture content. By so doing, defects as well as changes in moisture content occurring during storage will be minimized, if not entirely eliminated, thereby reducing loss of material during fabrication and subsequent use.

Effect of Storage on Moisture Content

In order to obtain definite information upon the effect of storage on the moisture content of lumber, the Forest Products Laboratory surveyed storage methods at sawmills, wholesale and retail distributing yards, and wood-using plants in various parts of the United States.

Illustrative of the results obtained is figure 1, based on a study at a Louisiana sawmill. Somewhat similar results were obtained at a Florida sawmill and at several distributing yards in the vicinity of Chicago. The stock at the Louisiana mill was southern yellow pine 1- by 4-inch by 12-foot flooring and 1- by 8-inch by 12-foot boards surfaced four sides and solid piled -- that is, piled without stickers. A group of boards selected for uniformity of moisture content by means of a moisture meter was piled in each

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[1] Maintained at Madison 5, Wis., in cooperation with the University of Wisconsin.

of the following locations: (1) In a yard where the pile was well protected by a tight roof; (2) in a partly open shed with metal roof; (3) in an open shed with wood roof; and (4) in a closed shed with a wood roof. Each curve in figure 1 represents the changes in average moisture content of 80 boards.

The average moisture content values, which were initially about 7.5 percent, ranged between 10 and 11 percent after 10 months in the three sheds. In the yard the average moisture content reached 13.5 percent during the same period. These are average values; the ends and other surfaces of the boards exposed directly to the air would have moisture content values higher than the average. The relatively large absorption of moisture at the ends is objectionable either in the rough lumber or in a finished product such as flooring. When the rough lumber is surfaced, the boards will have a uniform width only at the time of machining; subsequently the ends will shrink and will be narrower than the remaining portions of the boards. In a finished product, assuming that the boards are fairly uniform in moisture content when machined and subsequently absorb moisture during storage, the ends will become wider and thicker than they should be.

The effect of temperature and relative humidity on equilibrium moisture content is shown in figure 2. For example, at the average indoor temperature of 70° F. and relative humidity of 42 percent, the equilibrium moisture content of wood is 8 percent. It has been found that, for the most satisfactory service, such products as flooring and interior finishing woodwork in conventionally heated dwellings in most parts of the United States should be installed at about 8 percent moisture content.

Assume that in an unheated shed the temperature and relative humidity are respectively 30° F. and 75 percent. According to figure 2, the corresponding equilibrium moisture content is 15 percent. If the shed is tightly constructed, so that no extraneous sources of moisture are present, the equilibrium moisture content can be reduced to 8 percent by merely heating the air in the shed to about 45° F. (See dotted line in figure 2.) In this way steam sprays, water sprays, desiccants, or refrigeration are not required. Further, the heat loss under this condition is less than if a common temperature of, say, 60° or 70° F. were maintained.

Undesirable changes in the moisture content of lumber within closed storage sheds can be largely prevented.[2]

During storage, all the lumber tends to come to the same moisture content. In other words, the range in moisture content between individual pieces becomes less with storage (fig. 3). This is advantageous if storage conditions are properly maintained, particularly if the moisture content of the lumber varies considerably after kiln drying.

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[2] Forest Products Laboratory Report No. R1140, "Moisture Fluctuations in Lumber Within Closed Storage Sheds Controlled With Electrical Equipment."

Effect of Storage on Moisture Gradient and Drying Stresses

A further advantage of storage is that it gives time for the moisture content to equalize throughout the thickness of each piece. With some woods, especially softwoods, the storage period and equalization of moisture content may be sufficient for the relief of drying stresses. Some species, particularly hardwoods, on the other hand, may show severe drying stresses even after extended periods of storage.

Under poor storage conditions, stresses may be induced in the lumber. Outside storage of kiln-dried lumber, for example, may cause reverse case-hardening in boards that are exposed to snow or rain. Further, the absorption and subsequent drying may cause old checks to open up and new ones to develop.

Effect of Storage on Splitting of Lumber

Frequently, rather heavy losses from splitting occur during storage of lumber or partially made products, especially in workshops heated during the winter. It is not uncommon, during winter months, for the equilibrium moisture content in heated shops to be as low as 4 percent while being as high as 18 percent or more in unheated storage sheds. The ends of lumber stored in these sheds consequently may have a very high moisture content, and upon exposure to the dry conditions of the workshop will end dry rapidly, which may cause end checks and splits. Exposure of freshly cut ends of lumber that have a comparatively high moisture content to dry conditions may also cause end checks and end splits.

The faces of partially fabricated pieces may split if the pieces are stacked so that they are only partially exposed to the low equilibrium conditions. Shrinkage of the exposed face may also be sufficient to cause opening of glue joints. Splits and openings of this nature are more common in stock with a high core moisture content, one face of which has been partially cut away, thereby exposing the zone of high moisture content. A good example of this is a chair saddle seat.

Storage of Green, Air-Dried, and Kiln-Dried Lumber

It is difficult to store green lumber for an appreciable period of time without loss from stain, decay, or insect attack. It can be done, however, by under-water storage or storage at low temperatures, that is below 35° F. The danger of stain and decay can also be minimized by treating the green lumber with some of the toxic chemicals used to prevent blue stain.[3]

[3] U. S. Forest Products Laboratory. "Cause and Prevention of Blue Stain in Wood. Technical Note No. 225. (In cooperation with Div. of For. Path., Bur. Plant Ind., Soils, and Agr. Engr.)

kiln
The best practice, however, is to start drying as soon as possible after cutting the log into lumber.

If the season of the year is advantageous, air-dried lumber may be stored by leaving it stickered in the air-drying pile. The best method of storage, however, would be to pile it in open, partially closed, or unheated closed sheds. It could be sticker piled or, if the average moisture content is below 20 percent, solid piled. Storage in this manner will best maintain the final air-dried moisture content without causing losses or decay from exposure to the elements.

Kiln-dried lumber should be given the best of care in storage. There is no advantage in kiln drying lumber to a low moisture content if during storage it eventually attains the moisture content of air-dried stock. Preferably, kiln-dried lumber should be stored in closed heated sheds in which the equilibrium moisture content is controlled. If such sheds are not available, storage in the upper part of a closed or partially closed shed in which the temperature is slightly higher than the outside temperature is desirable.

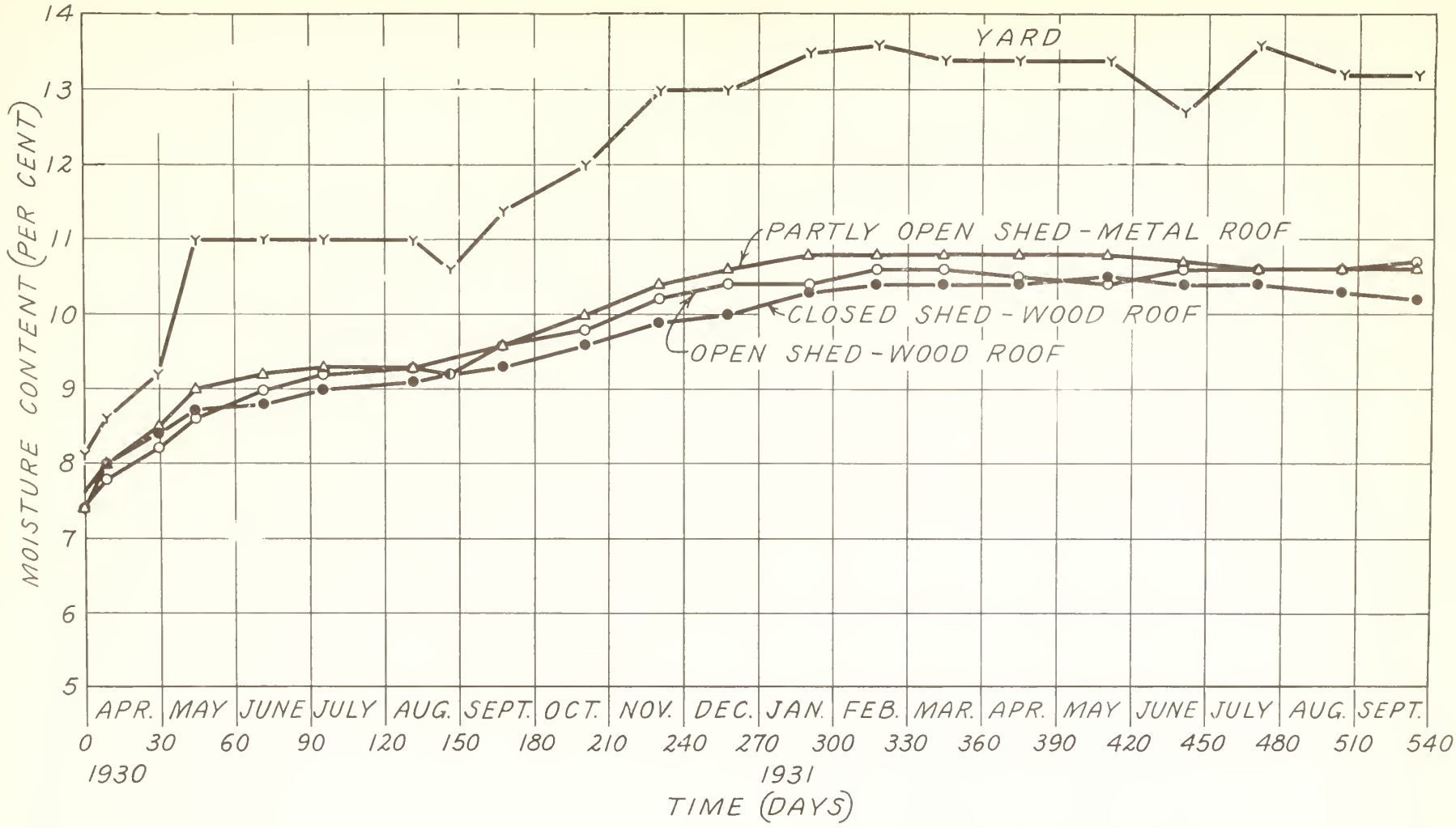

Figure 1.--Average moisture content changes in southern yellow pine 1 by 4 inch flooring and 1 by 8 inch boards surfaced four sides, stored in a solid pile in each of four different locations.

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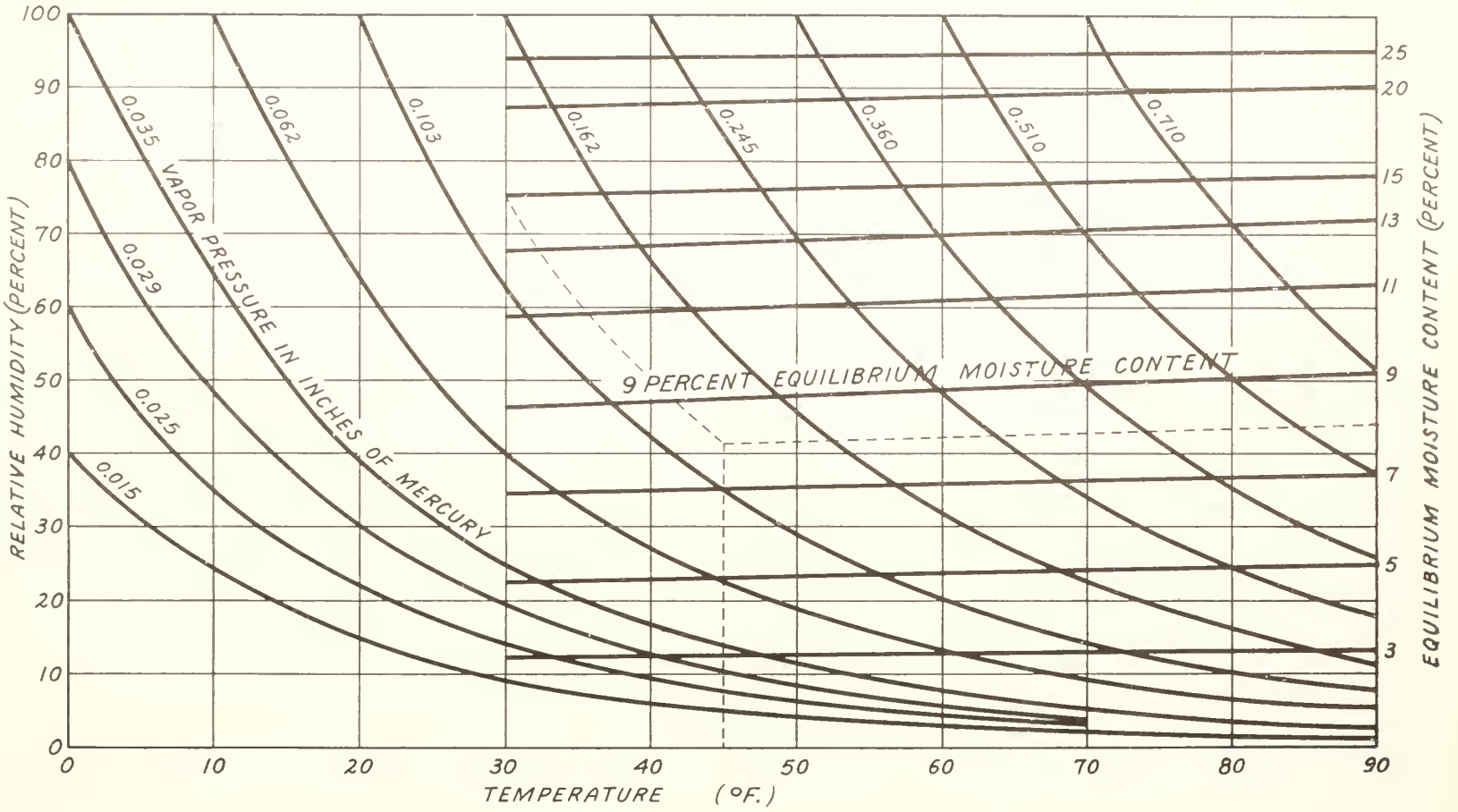

Figure 2.--Relation of the equilibrium moisture content of wood to the temperature and relative humidity of the surrounding atmosphere. (Dotted line illustrates the example cited.)

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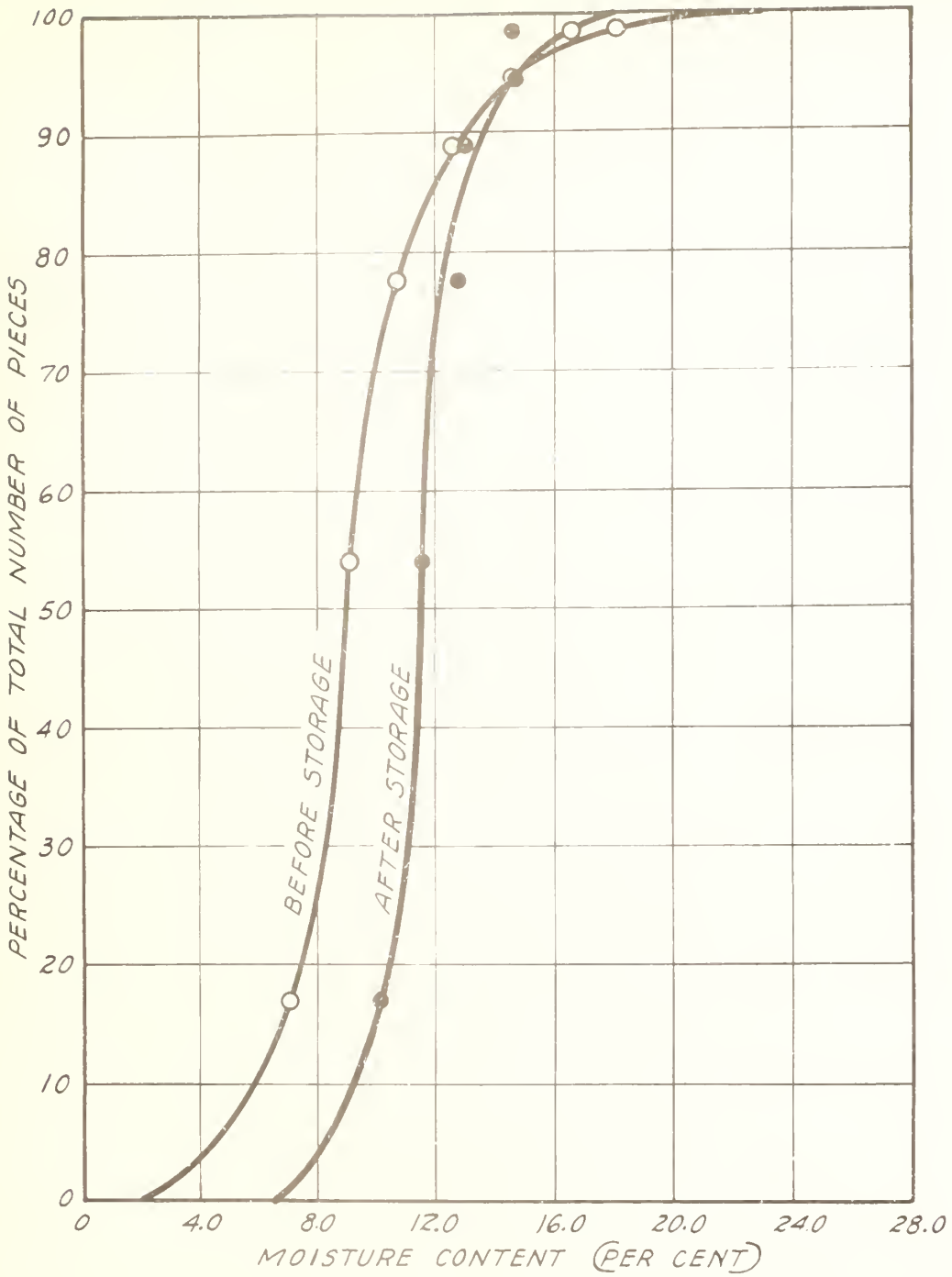

Figure 3.--Range of moisture content of a package of 1- by 6-inch Douglas-fir boards before and after storage for 1 year within a closed unheated shed. Initial average moisture content was 10.3 percent. Final average moisture content was 12.1 percent.

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